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WATER POLLUTION CONTROL FEDERATION,
SLUDGE DEWATERING MANUAL OF PRACTICE.
APPENDIX A. DEFINITIONS

Donald Dean Adrian, et al

Massachusetts University
Amherst, Massachusetts

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WATER POLLUTION CONTROL FEDERATION

Sludge Dewatering Manual of Practice

Appendix A: Definitions

Dr. Donald Dean Adrian, Associate Professor of Civil Engineering

Dr. John H. Nebiker, Assistant Professor of Civil Engineering

University of Massachusetts

Amherst, Massachusetts

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1. activated sludge - a biological growth produced by the activated sludge process. Waste activated or excess activated sludge is the component to be disposed. Return sludge is recirculated within the biological treatment process.
2. adsorption - the agglomeration of micro particles and/or ions on surface active particles.
3. alkalinity - the capacity for neutralizing acid. Bicarbonate alkalinity is due to the presence of bicarbonate in the absence of hydroxide or carbonate alkalinity. Methyl orange or methyl purple alkalinity measures total alkalinity. Phenolphthalein alkalinity generally results from the presence of hydroxide or normal carbonate.
4. alum - aluminum sulfate ($Al_2 (SO_4)_3 \cdot 18H_2O$); used as a coagulant.
5. anion - a negatively charged ion.
6. B.O.D. or biochemical oxygen demand - the amount of oxygen required for the biological oxidation of degradable organic content in a liquid, in a specified time and a specified temperature. Usually expressed in mg/l as 5-day 20°C BOD.
7. biological sludge - also known as secondary sludge. Includes all activated sludges, and trickling filter humus.
8. British thermal unit (BTU) - a unit of heat equal to the amount necessary to raise one pound of water one degree Fahrenheit.

9. Buechner or Buchner funnel - a laboratory device for filtering, used with filter papers, cloths or other media, frequently used to determine specific resistance of sludge.
10. cake compressibility factor (s) - also known as the coefficient of compressibility. An empirically derived factor relating specific resistance of sludge cake to filtering pressure (dimensionless).
11. cake solids - percent dry solids in wet cake discharged from filter; as commonly reported this includes weight of sludge conditioning chemicals which may amount to 5 to 15 percent of the dry sludge solids.
12. cation - a positively charged ion.
13. centrate - natant sludge liquor removed from the sludge suspension by centrifugation.
14. centrifuge - a dewatering device utilizing centrifugal force for concentration of suspended matter. A centrifuge may either thicken or dewater sludge.
15. chemically precipitated sludge - sludges resulting from the addition of coagulants and flocculants to wastewaters. Many sludges from advanced waste treatment and wastewater renovation are of this type.
16. clarification - removal of turbidity or other suspended solids from the suspending liquid.

17. coagulant - a chemical added to wastewater or sludges to promote agglomeration and flocculation of suspended solids in order to induce faster settling or more efficient filtration. Typical coagulants are the polyelectrolytes, alum, and ferric chloride.
18. colloid - a nonsettleable suspended solid.
19. conditioning - a pretreatment of sludge to facilitate water removal.
20. Copperas - a chemical, ferrous sulfate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$), used as a coagulant. Chlorinated copperas has the formula ($\text{FeSO}_4 \cdot \text{Cl}$).
21. dehydrating - removal of moisture by drying, usually at elevated temperatures. Hydrate water is molecularly bound in a solid. The adjective anhydrous refers to a dehydrated material, such as anhydrous lime.
22. dewatering - any process of water removal or concentration of a slurry such as by filtration or drying.
23. dewatering bed - a wastewater treatment unit usually containing a sand filter upon which sludge is placed to dewater by gravity. Usually synonymously the same as a drying bed or a sludge bed.
24. diatomaceous earth - an inorganic powder used as a filter aid or filtering medium.

25. digested sludge - sludge biologically stabilized by either aerobic or anaerobic digestion.
26. dosage or dose rate - dry weight of coagulant added to sludge per unit weight of dry sludge solids. Frequently expressed as a percentage of dry sludge solids.
27. drum submergence - also known as filter submergence. Fraction of the total drum filter area of vacuum filter which is submerged. Also defined as the ratio of filter cake form time to total cycle time.
28. drying bed - a wastewater treatment unit usually containing sand upon which sludge is placed to dry by evaporation. Usually synonymously the same unit as a sludge bed or a dewatering bed.
29. effective size - the sieve size which will pass 10 percent by weight of a soil or sand. Designated as d_{10} .
30. elutriation - a washing of sludge, usually with sewage effluent, reducing the sludge alkalinity and fine particles, and thus decreasing the amount of required coagulant in further treatment steps.
31. feed solids - percent by weight of suspended solids influent to centrifuge, vacuum filter, elutriation tank, or other dewatering device.
32. ferric chloride - a chemical, FeCl_3 , commonly used for sludge conditioning.

- 33. filter aid - materials added to sludge to increase the rate of dewatering.
- 34. filter blinding - clogging of filter media by sludge particles or coagulants.
- 35. filter leaf - a laboratory device for testing potential performance of a vacuum filter on a sludge.
- 36. filtrate - natant (sludge liquor) removed from a sludge suspension by filtration.
- 37. filtration rate (W/A) - a rate of solids removal by vacuum filtration expressed as weight of dry cake solids per unit area ($\text{lbs/ft}^2/\text{hr}$).*
- 38. form filtration rate ($W/A\theta$) - rate of suspended solids removed by vacuum filtration expressed as weight of dry cake solids per unit area and formation time ($\text{lbs/ft}^2/\text{hr}$).*
- 39. form time - time period during one drum revolution of vacuum filter in which vacuum is applied for cake formation.

* As commonly reported these include the weight of chemicals used for sludge conditioning, which may amount to 5 to 15 percent of the dry sludge solids.

- 40. Imhoff tank sludge - a digested primary sludge produced by an Imhoff tank. Sometimes humus sludge is also digested in Imhoff tanks.
- 41. ions - dissociated charged atom or group of atoms in a solution.
- 42. liquor - also known as sludge liquor or natant. The liquid portion of sludge, or water removed during concentration process such as filtrates, centrates, subnatants, and supernatants from sludge digestion tanks or sludge concentration tanks.
- 43. load factor - fractional amount of time that a machine is in operation.
- 44. mesh number - a measure of the number of wire grids in a mesh per inch. These are standardized as the U. S. Series and the Tyler Series.
- 45. mixed sludge - a mixture of raw or digested primary and secondary sludges. In some activated sludge plants the sludges are mixed by returning waste sludge to the primary sedimentation tanks.
- 46. moisture content - also called water content. Weight of water in the sludge per unit total weight of sludge. Expressed as percent.
- 47. nonionic - referring to an uncharged or electrically neutral particle.
- 48. oxidation - process which increases the proportion of oxygen, acid-forming element, or radical in a compound.

49. pH - the base-10 logarithm of the reciprocal of the concentration of hydrogen ion in solution. The pH range is from 0 to 14, the lower numbers representing acidic conditions; the higher alkaline condition. A pH of 7 represents a neutral solution.
50. pickling liquor - acid solution used to clean metal surfaces.
51. polyelectrolytes - long-chained, high molecular weight, synthetic, water soluble, organic coagulants, also referred to as polymers.
52. polymers - long-chained, high molecular weight, synthetic, water soluble organic coagulants, also referred to as polyelectrolytes.
53. polyvalent - referring to atoms or atomic radicals with more than one free electrical charge.
54. pretreatment - as applied to sludge concentration, pretreatment means conditioning or treatment previous to concentration in order to make the sludge more amenable to the desired process.
55. raw sludge - highly putrescent solids removed by wastewater treatment processes. It is generally any undigested wastewater sludge, although it is frequently used in describing solely undigested wastewater sludge removed in primary sedimentation.
56. reducing agent - a material which can change a molecule from a higher to a lower oxidation state. Electrons are added to the molecule as it is being reduced.

57. secondary sludge - biological sludge such as activated sludge or trickling filter humus.
58. sludge - a pseudo-homogenous, semi-colloidal suspension of organic and inorganic solids removed from wastewaters by clarification.
59. sludge cake - dewatered sludge resulting from filtration or centrifugation. Cake is generally plastic in nature ranging from a spadable mud to a forkable stiff consistency. An air dried sludge cake may assume an extremely rigid form.
60. solids content - also called percent total solids. Weight of total solids in sludge per unit total weight of sludge. Expressed in percent. Water content plus solids content equals 100%.
61. solids recovery - fraction of solids retained in sludge concentration process. Amount of recovery plus amount recycled per unit of time equals the solids inflow to the concentrator.
62. solids recycle - solids returned with sludge liquor to beginning of treatment process.
63. solute - substance in solution.
64. specific gravity - the ratio of the weight of a substance to the weight of an equal volume of water.

65. specific resistance - a sludge filterability index (generally expressed as sec^2/gm).
66. suspended solids - non-colloidal material removed from a liquid by laboratory filtration using a Gooch crucible.
67. syneresis - destruction of a gel structure by heat-treatment.
68. thickened sludge - a sludge concentrated to a higher solids content by gravimetric settling, centrifugation, or by air flotation.
69. total cycle time - time required for one complete revolution of a filter drum.
70. total residue - also known as total solids. Residue remaining after drying at 103°C .
71. trickling filter humus - sludge removed in clarifiers following biological stabilization in trickling filter units.
72. underflow concentration - the solids content of the sludge thickened and removed from the bottom of a clarifier or thickener.
73. uniformity coefficient - the ratio of the sixty percent sand size to the ten percent sand size, i.e., d_{60}/d_{10} . These respective sizes refer to the sieve size which will pass the corresponding weight percentages to the total of a soil or sand.

- 74. vacuum filter - a sludge dewatering device utilizing a vacuum applied across a filter medium and sludge cake for liquor removal.
- 75. van der Waals force - the force of mass attraction between floccules.
- 76. viscosity - a flow characteristic, (poise).
- 77. volatile content - determined by weighing previously dried material before and after heating to 600°C. Generally assumed to indicate organic content.
- 78. wash water - may specifically refer to sewage effluent used for elutriation.
- 79. water content - also called moisture content. Weight of water in sludge per unit total weight of sludge. Expressed in percent.
- 80. wet air oxidation - a heat and pressure treatment designed to synerise and oxidize sludge particles.
- 81. zeta potential - an electrical charge at the boundary between particles and the suspending medium that is related to repelling forces between floccules. Measured by the zetameter.